REMARKS

Claims 2-15, 17-27 are active. Claims 1 and 16 are canceled. Claims 25, 26 and 27 are new. The claims were subject to restriction now withdrawn. The drawings are objected to. The abstract and the disclosure are objected to. Claims 17, 19 and 20 are objected to. Claims 2-3, 5, 14-15, 23 are rejected under 35 USC 112, first paragraph. The amendment filed 2/17/09 is objected to under 35 USC 132. Claims 4, 11, 12, 17 and 20-23 are rejected under 35 USC 112, second paragraph. Claims 4-10, 12 and 13 are rejected under 35 USC 103 as being unpatentable over Friend in view of Sakai. Claims 2-3 and 14-15 are rejected under 35 USC 103 as being unpatentable over Friend, Sakai and Schmidt. Claim 11 is rejected under 35 USC 103 as being unpatentable over Friend, Sakai and Kelley. Claim 20 is rejected under 35 USC 103 as being unpatentable over Noddin, Kurashima and Jonas. Claims 17-19 and 21-24 are rejected under 35 USC 103 as being unpatentable over Noddin, Kurashima and Jonas.

Applicants thank the Examiner for his constructive comments.

INFORMAL MATTERS

The Abstract

The Abstract has been amended as requested and replaced with a new abstract.

The Drawings

The drawings are objected to, mainly Fig. 7, because the reference numeral 5 in the specification is in error. This is not a drawing error, but a typographical error in the written description. The specification is amended to delete this reference numeral. The drawing Fig. 8 is acceptable.

The Specification

The specification has been amended as noted above to remove the reference to

layer 5 missing in Fig. 7. The so called first sentence is the title [0001] and not part of the specification per se and is deleted. The requested punctuation objection is moot.

The term PP objection under 35 USC 132

The Action states that the term added "(polypropylene)" added to Para.[00014] is new matter and that "The originally filed disclosure provides no support for PP being polypropylene." The Action states "polypropylene is not the only material that uses PP as an abbreviation and it is not clear that this material was the one intended at the time of the invention."

The above statement in the Action verifies and admits that PP is in fact polypropylene. While the term PP is asserted in the Action as constituting other materials as well, the Action erroneously states simply because PP includes a plurality of materials, one specific material of such a group can not be mentioned later in an amendment as new matter. This is not the law. Since PP includes polypropylene as admitted by the Action, then it is not new matter to specifically mention it (or any of the other materials represented by this term) expressly in a later amendment. These materials are inherent in the use of the term PP and must always be present. These materials are not mere possibilities. An applicant is permitted by the law (See MPEP 2163.07(a)) to amend an application to expressly include that which is inherent in the as filed specification, which previously was silent as to such inherent material.

Polypropylene is inherently disclosed by the disclosure of the term PP. The fact that applicant wishes to expressly refer to polypropylene does not make such an expression new matter. Polypropylene was always disclosed in the disclosure of the express term PP as the Action now admits.

See MPEP 2163.07(a) and cited cases in regard to inherency in an application and the addition of such inherent subject matter later. If the missing description, the term polypropylene, is present in the disclosure by the mention of the term PP as admitted by the Action, it is inherently disclosed, it is always present, and is not merely a possibility as being present, and may be expressly added by amendment later without introducing new matter. If the Examiner persists in this line of reasoning, he is expressly asked to provide authority that by the mere mention of a symbol in a specification that means or designates a plurality of known elements, that the later inclusion of the elements so defined by the definition or any portion of the definition by including expressly one of the elements of the symbol is new matter, because applicants know of no such authority.

For the reasons given, the objections to the specification, abstract and drawings are believed met and this basis of the rejection should be withdrawn.

The claims

Claims 17, 19 and 20.

Certain of these claims are amended as suggested to advance the prosecution of this application. The objections are not based on 35 USC 112, 2nd paragraph and thus are not objectionable, but merely based more on personal style of the Examiner with respect to grammar and form, which are not objectionable. One of ordinary skill would understand these claims without the amendments suggested and that is all that 35 USC 112 ,2nd ¶ requires.

Certain of the claims have been amended to meet others of the objections based on the formal matter issues, or to improve their form. No new matter is introduced.

While certain of the objections are not appropriate and not based on 112, some of the suggested changes are made to advance the prosecution of this application. For example, where one of ordinary skill would understand what prior element is being referred to, the claim is clear on its face and is not objectionable. All modifiers of a claim need not be repeated verbatim every time that element is presented when the claim is other wise clear as to which element is being referred to. This requirement improperly exalts form over substance. MPEP2173.02 p. 2100-219 (top paragraph R.H,. col.) states that if an applicant objects to amending the application as suggested by such non-35 USC 112 objections, the Examiner should not pursue the issue.

The rejection of Claims 2-3, 14-15 35 USC 112, 1st paragraph

Applicants traverse this rejection for the following reasons. The Action states that the specification does not disclose the combination of elements including the disruption element and the truncated cross section profile of the through plating. The Action states that the truncated profile of the through plating is disclosed in the embodiment of Figures 1-7 which does not have the disruption element. This is not true.

This objection is based on the fact that the specification does not use the term "disruption element" as in the objected to claims in this portion of the specification. There is no requirement that the exact same terms in the claims must appear in the specification. There need not be identity of terms. If the specification is understood by one of ordinary skill that the term used in the claims is described in the specification in the absence of the literal expression of the term, then this is acceptable.

35 USC 112, 2nd ¶ does not require that the specification describe the invention as claimed in words identical to the patent claims. The CAFC reversed the PTO for

rejecting an application in which the words "not permanently fixed" added to the claims did not appear in the specification. *In re Wright*, 9 USPQ2d, 1649 (Fed. Cir. 1989). The Federal Circuit was convinced that the process of the claim containing those words was described in the specification. The Court stated:

> All of this convinces us [after reviewing the specification disclosure] that it is the essence of the original disclosure that the microcapsules are not "permanently fixed" to their various supports. The examiner therefore was wrong in his underlying premise that the limitation added to the claim by amendment contained "new matter. The specification does unequivocally teach the absence of permanently fixed microcapsules."

By the same token, all of applicants figures and their underlying disclosure unequivocally teach the use of a disruption element as claimed to provide non-wetting of an underlying layer on which subsequent layers are deposited over the disruption element to produce a void in such later applied layers. A through plating, whether or not free standing, is shown in such a void.

Figures 2-7 show a through plating 3 on the lower layer 2. This is a free standing frusto conical through plating as shown. The specification at [0005] and [0006] last line each, states that the through-plating is applied or formed before the insulating layer is applied. This means this insulating layer is applied to the preformed through plating. Paragraph [0009] states that the vias are formed in the configuration of free-standing raised portions. This means that the so called free-standing raised portions are termed "vias" is the specification. In other words, the so called vias are the through-plating. See [0003]. The spec. continues: "It is advantageous if the surface of the vias is rough. . ." "the film of organic material breaks open at the through-plating points." This means the layer of organic material is applied to the through plating (the via) , which opens the layer to create a void in the layer as it is being applied. And this breaking open occurs

automatically. Line 8 of paragraph [0009]. At [0011], "the vias [the through-platings] are applied prior to the central functional layer."

It is plain from these paragraphs that the term "via" does not mean its ordinary English definition of a route or passage as would normally the term would be construed. Due to most likely the translation, the term "via" in the context of the specification is referring to the truncated frusto conical through plating, i.e., a conductive connector element, and not a space per se. While the through plating forms a void in the adjacent layers that are deposited later over it so that "voids" or passages in the layers are formed by the deposition thereof onto the through plating, normally the term "via' might not be applied to the through plating itself in the context of its English meaning. However, as is plain from the specification paragraphs quoted above, the term "via" is referring to the through plating itself and not to a space in which the through plating is located. Thus the term "via" may be a contributing factor to the misunderstanding of the disclosure. The through plating is a disruption element as employed in the disclosed embodiment of Figs. 2-7, regardless that the specification refers to it as a via.

Paragraph [0015] discusses Fig. 2 as showing a free standing through-plating 3 applied on the conductor track lower layer 2. The term "free-standing" merely means it is somewhat similar to a post, a stanchion or other upright structure not supported by any other structures. Fig. 2 plainly shows such a free standing through plating structure. This structure is created by printing or by lithography. Paragr. [0015].

Paragraph [0016] discusses Fig. 3 as showing the same structure as Fig. 2 where two further layers 4 and 5 are disclosed. It is to be understood that the layers 4 and 5 must be and are applied after the through plating 3 is formed according to the

disclosure. In Figs. 3 and 4 it is obvious that the layers 4 and 5 are applied to the through plating 3 after the plating 3 is formed and layers 4 and 5 are also applied to the lower layer 2 as shown in these figures.

What is misunderstood is the term "disruption element" which is discussed expressly beginning with paragraph [0021] and Fig. 8. It is intended that with respect to the later applied layers 4 and 5 of Figs. 3 and 4, that the term "disruption element" also refers to the through plating 3 of Figs. 2-7. In applicants' prior filed response applicants state at page 16 that the disruption is not expressly depicted in Figs. 3-7. This is error. Applicants regret this error and any inconvenience it may have caused the Examiner. The initially applied through plating 3 in these figures serves as a disruption element with respect to later applied layers.

In this context, the through plating acts as a disruption element to the extent it forms voids in the subsequently applied layers as shown in Figs. 3-7. These layers are not deposited on the top surface of the through plating as shown, which serves in this context as a non-wetting element for preventing these layers from being deposited thereon. Thus, for purpose of definition of the term "disruption element" as used in the claims, the through plating in one embodiment is such a "disruption element."

The embodiment of Fig. 8 is thus a second embodiment of a "disruption element." The disruption element of Fig. 8 [0021] is applied to the lower conductor track 2. It can be conductive or insulating material. It can be produced by chemical or physical treatment. Physical treatment means any physical disturbance on or to the lower layer 2 as represented, for example, in Fig. 8 by the disclosed element 7. In this embodiment, the layers are torn open by way of the element 7 and the through plating is filled in that

torn open region.

One must keep in mind the problem addressed by the present claimed invention as discussed in the specification at paragraphs [0004] and [0005]. The problem with the prior art is that previously, thorough-platings have been produced on the finished thin layers, in which case the risk of the thin layers being damaged weighs very heavily because the functionality of the entire component is brought into question as soon as one of the layers is damaged. See [0004]. What this means is that in the prior art involving thin film technology fabrication of electronic components, the thin sensitive delicate layers are sensitive to mechanical stress and/or chemical solvents (etching agents for example) use to produce the vias which are later filled to form the so called through plating. In the prior art, the various component layers are produced first and then the vias (the passages therethrough) are formed in these layers.

Applicants' paragr. [0004] is stating that by producing the vias in the prior formed layers, after these layers are formed, the layers may be damaged by such via formation, and thus, the integrity of the component may be affected, damaging the component. The prior formation of vias through the prior formed layers diminishes the reliability of such components. Applicants' solution to this problem is provide a disruption element on a lower layer to which the component subsequent layers are applied. This disruption element forms voids in the layers as they are formed or permits the voids to be readily formed without damaging the layers as in the prior art. Thus holes or vias need not and are not subsequently formed in applied layers using the through-plating as a disruption element as disclosed by applicants.

By way of example, the cited Noddin reference teaches away from applicants'

disclosed solution to the problem by forming vias such as via 12 in the various layers using a laser technology. This is what applicants specification states is undesirable.

The cited reference to Kurashima also teaches away from applicants' disclosed solution. In this reference a semiconductor wafer is formed into a chip or wafer [0099]. Such wafers are typically known in this art to be inorganic SiO_2. Through holes are formed in the chip [0105] using a laser. Since the chip 10 is formed later with through holes 18, 24 by a laser, this is no different than Noddin. An insulating material is then formed in the holes 18, 24. [0109] [0114], holes 24 penetrating the insulating material 22. The problem and claimed solution addressed by applicants' disclosure is not recognized by these cited references. There is no disruption element as disclosed and claimed by applicants disclosed in these references. In the references, the through plating is filled into the prior formed holes to form a conductive element, Kurashima [0118]. In contrast, the through plating 3 of applicants' Figs. 1-7 disclosure is formed initially and not by filling vias formed in the various layers. This is plainly a disruption element with respect to the later applied layers and would be so understood by those of ordinary skill.

Applicants' paragraph [0022] is amended in view of the above discussion to express what is intended by and what is disclosed by the present disclosure, in view of the erroneous construction of the disclosure by the Action. This paragraph [0022] calls for:

> [0022] The disruption 7,Fig. 8, provides that, around it, the subsequently applied central functional layer 4 tears open (as manifested by the larger region of the layer 6 contiguous with the layer 2 next adjacent to the disruption 7, Fig. 8) and/or, in the alternative, the layer 4 as shown in Figs. 5-7 (or layers

4 and 5) are absent, in the region of the through plating 3 being shown mounted directly on the layer 2, due to non-wetting or in some other fashion, by the presence of the non-wetting element on the layer 2, so that a region is produced around the disruption 7, Fig. 8, (or as in Figs. 3-7, a void is created in the layers due to the presence of the non-wetting element, e.g., the through plating 3, or its equivalent), in which the lower layer 2 to be contacted, as per Fig. 8, is exposed, in the operation of forming the upper layer 6 to be contacted.

No new matter is introduced by this amendment as shown by the following:

1. (as manifested by the larger region of the layer 6 contiguous with the layer 2 next adjacent to the disruption 7, Fig. 8)

This description is plain from and is shown by figure 8 and merely describes the elements shown in the figure.

2. in the alternative, the layer 4 as shown in Figs. 5-7 (or layers 4 and 5) are absent, in the region of the through plating 3 being shown mounted directly on the layer 2, due to non-wetting or in some other fashion, by the presence of the non-wetting element on the layer 2, so that a region is produced around the disruption 7, Fig. 8, (or as in Figs. 3-7, a void is created in the layers due to the presence of the non-wetting element, e.g., the through plating 3, or its equivalent),

This description is plain from and is shown by figures 3-7 and the corresponding text and merely describes the elements shown in the figures as described previously in the specification as discussed above. In other words, the through plating also acts as a disruption element when it is initially formed on the lower layer 2 and the subsequent layers are deposited onto layer 2 and onto and around the through plating, which prevents the deposition of such layers thereon. As the specification discusses and the drawings show, the through plating forms openings or voids in these subsequently applied layers as they are formed as shown by figures 3-7 and the accompanying text, and as would be understood by one of ordinary skill. This arrangement avoids the

problem of the prior art of possibly damaging organic or other layers that are formed first and then forming the through plating vias later such as by a laser, etching, etc.

The Action construes the through plating and disruption elements as different things in Figs. 1-7 which is not what is intended. Applicants regret any confusion in view of their prior description of these figures in their prior response. It should be plain that in reviewing the specification as a whole, especially the discussion of the through plating as a free standing structure and the deposition of the layers onto this structure later and which layers are shown surrounding the through plating, the through-plating in Figs. 1-7 is the disruption element. The through-plating inherently produces voids in the later applied layers at the location of the through plating. These voids are created by the through plating during the deposition of the layers and thus the through-plating is a disruption element. The through-plating performs a non-wetting function as discussed by the very absence of any of the later applied layers on top of the through plating in the figures 3-7. This is another embodiment of the disclosed disruption element as compared to that of Fig. 8 and which was not construed as such in the Action.

Also, see paragraph [0024] stating:

> [0024] The through-plating 3 is therefore produced in such a way that, upon application of the semiconductor and insulator layer, the lower layer 2 in Figure 1 is locally not wetted. In other words, at the location of the vias [the through plating] holes are deliberately produced in the layers which are to be through-plated.

The reference to Fig. 1, and the fact that layer 2 is stated as not being wetted at the location of the vias plainly discloses that a disruption element is present at such a location to produce such holes. As shown in Figs. 2-7, the through plating produces such holes and thus prevents the wetting of the lower layer 2 at this location and thus

represents a disruption element as so defined.

In the Office Action, in the response to arguments starting on page 6, as to the citations not being supported at the locations of applicants' specification recited by applicants, the copy of the specification being referred to is one with out the paragraph numbers, the original verified translation and not the specification copy with the paragraph nos. added. As a result, applicants' cited locations do not agree with the application version with the paragraph nos. added. The referred to passages of the specification in applicants' prior response refer to the verified translation not having the paragraphs therein. Applicants regret this error and any inconvenience caused the Examiner. As to the so called erroneous citations: Page 6,lines 4-5- see paragr. [0024]. Page 6, line 12 and lines 15-16-see paragr. [0025]. All of applicants' quoted citations appear in the filed specification unfortunately not at the cited locations per the filed specification copy. However, regardless of those citations, in view of the above discussion, the various Figs. 2-7 disclose a disruption element in the form of the through-plating.

The Action on page 7 states that there is absolutely no statement anywhere that the disruption element can be used in combination with the embodiments of Figs. 1-7. The use of the term "disruption element" is not required as discussed above, *In re Wright,* as long as one of ordinary skill would understand this is what is disclosed. As discussed, the disruption element is the through-plating itself and one of ordinary skill would understand this. The use of this term in the claims is not new matter or otherwise objectionable.

For these reasons, the rejection of the claims based on the Action's interpretation

of the specification should be withdrawn. Also, as in [0005] and [0006] the insulation layer is applied after the through-plating is formed. One of ordinary skill would understand that the through plating itself is the disruption element from Figs. 1-7 for such later applied layers. For these reasons, this basis of the rejection is believed met and should be withdrawn.

Claim 5

This claim is rejected under 35 USC 112, 1st paragr. The Action states that the rough surface of the through-plating is disclosed in the embodiments of Figs. 1-7 which does not have the disruption element. For the reasons discussed above, the disruption element is the through-plating and so this basis of the rejection also is met and should be withdrawn.

Claim 4

This claim is rejected under 35 USC 112, 2nd paragr. This claim is amended to meet the objection based on formal matters and calls for:

> The electronic component as set forth in claim 13 wherein at least one of the plurality of layers is selected from the group consisting of an insulating material including polyhydroxystyrene, polymethylmethacrylate, and/or polystyrene, or a semiconducting material including polyalkylthiophene and polyfluorene and a mixture thereof.

Applicants believe that this claim as amended is definite. One of ordinary skill could readily construe this claim as including an insulating material or a semiconductor material and at least one of the plurality of layers consists of at least one of the listed materials. The Action discusses construing this claim in terms of the disclosure and does not know which figures to apply, but applies only Fig. 8. This lack of ability to construe the claim by the Examiner does not make the claim indefinite. The claim as is

the application, is directed to those of ordinary skill.

The Action indicates it is not clear what is being claimed and that this claim can only be based on figure 8 on the basis the disruption element being deemed not shown in Figs. 1-7. This boot straps the specification construction error into an error in construing the claim. The construction of the specification conclusion is wrong as discussed above. The indefiniteness conclusion of claim 4 on this basis is not based on indefiniteness, but on so called lack of support. Claim 4 has support since it can be construed in view of Fig. 3, wherein the through-plating 3 is the disruption element. The plain language of amended claim 4 can be readily construed by one of ordinary skill which is all that 112, 2nd paragr. requires. This claim is not indefinite.

Since claim 4 is part of the original disclosure, notwithstanding it is rewritten to improve its form, it serves as part of the original disclosure. Since the premise of the rejection that this claim can only be based on Fig. 8 is wrong, the claim is improperly construed.

The claim is also rejected on the basis of improper Markush grouping. The claim is amended to overcome this objection. The rejection of claim 4 should be withdrawn.

Claim 11

The claim is amended to expressly include polypropylene and the term "PP" is deleted. The Action admits that PP includes polypropylene so this amendment is proper. There is no new matter issue for the reasons discussed above. The objection to claim 11 is believed met.

Claim 12

This claim as amended calls for:

A process for the production of at least one through plating of an electronic component comprising:

forming a plurality of layers of different material including a first lower layer, a majority of which layers are of predominantly organic material and which majority of layers includes an insulating layer, the forming of the first lower layer being followed by forming subsequent layers deposited sequentially one on the other contiguously onto and with the first lower layer, the forming of the first lower layer including forming a disruption element on the first lower layer, which element is arranged to result in a void in at least two layers of a first portion of the subsequently deposited layers on the first lower layer, and then forming a through plating in the resulting void through the at least two layers wherein at least two layers of a second portion of layers of the subsequently deposited layers are ohmically coupled to each other by the through plating.

The Action objects to the language:

> forming a plurality of layers of different material including a first lower layer, a majority of which layers are of predominantly organic material

There is nothing indefinite about this clause. A majority means more than 50%. The Action queries whether the plurality of layers includes the first lower layer or excludes it. Applicants are perplexed by this query. The claim expressly states that the plurality of layers includes the first lower layer. It is not understood the reason for the questioning this clause as excluding the first lower layer when the claim expressly states the plurality of layers includes the first lower layer. This clause is not indefinite.

The Action objects to the following clause of claim 12, which is amended as noted as follows:

> a majority of which layers are of predominantly organic material and which ~~organic material~~ majority of layers includes an insulating layer,

It is believed that this amendment addresses the objection to this clause. It should be plain that it is the majority layers (that are organic material) that is intended to include an insulating layer, and not the organic material per se. This is a typographical error.

Applicants thank the Examiner for bringing this error to their attention. The specification makes clear what is intended.

The Action objects to the following clause of claim 12 which is amended as noted by the underlining.

> the forming of the first lower layer being followed by forming subsequent layers deposited sequentially one on the other contiguously onto and with the first lower layer,

The Action states this clause is indefinite because it is unclear how the subsequent layers relate to the plurality of layers or if the "subsequent layers" are new elements not part of the plurality of layers. This objection is not understood. The claim calls for a plurality of layers. There is a first lower layer. There are subsequent layers deposited one on the other contiguously onto and with the first lower layer. Even without this amendment it is not understood how this clause could be construed as the subsequent layers relate to new elements, when the first lower layer is followed by subsequent layers, and the claim calls for forming a plurality of layers including the first lower layer. This objection is without basis. It is not understood how subsequent layers could be formed on the first lower layer and not be construed as part of the plurality of layers, which includes the first lower layer. This objection is hypertechnical and is not based on a convincing line of reasoning. Of course the plurality of layers includes the subsequent layer. Such subsequent layers would not be construed by one of ordinary skill as suggested by the Action. Such a suggestion is not reasonable. One does not make a definite claim indefinite merely for the purpose of rejection as a remote possibility. That is improper.

The Action states that it is unclear how an insulator layer can be ohmically

coupled to anything since it is an insulator. Claim 28 does not call for such language. It calls for:

> wherein at least two layers of a second portion of layers of the subsequently deposited layers are ohmically coupled to each other by the through plating

The majority of the plurality of layers are organic material and include an insulating layer. However, this objected to clause calls for at least two layers of the subsequently deposited layers are ohmically coupled to each other by the through plating. This clause does not mention the referred to insulating layer as being expressly coupled to the through plating, although the insulating layer could be so coupled. The Action assumes by improperly importing into the claim the disclosure that one of the at least two layers must be an insulating layer. There is no basis in law or fact for such a conclusion. Claims are read in light of the specification. The Action imports a limitation into the claim from the specification that the at least two layers must include an insulating layer. The construction of the claim is narrower than the claim. The at least two layers need not be an insulator.

The specification discloses various embodiments. A claim is construed in light of the specification and not as if one embodiment of the specification were the only embodiment per se. The at least two layers coupled to the through plating need not necessarily be an insulator.

Further, the Action queries how an insulator is ohmically coupled merely because it is an insulator. The Action assumes the layer is an insulator, which it is not as claimed as discussed above. However, even assuming arguendo the layer as claimed were an insulator as asserted, the claim is definite. Ohmic coupling merely refers to a

resistive coupling. The through plating forms an electrical resistive coupling to the layers to which it is coupled, whatever those layers may be. An insulator can be resistively coupled to a conductor. Capacitors are so constructed, i.e., two conductors coupled to and spaced by a dielectric. Resistive, i.e., ohmic, coupling does not mean a current must flow through such coupling. An insulator is merely a high resistance. A conductor is not precluded from being coupled resistively to a high resistance. This clause is not indefinite.

Claim 17

This claim is rejected under 35 USC 112, 2nd ¶ and is amended accordingly. It is believed that the objected to terminology, as amended herein, obviates the objection. This claim is believed to be in proper form.

Claim 20

This claim is rejected under 35 USC 112, 2nd ¶ and is amended accordingly. It is believed that the objected to terminology, as amended herein, obviates the objection. This claim is believed to be in proper form. The Action states it is unclear if the claim is referring to at least two of both first and second layers, at least two of each of the first and second layers, or at least two of the combination of the first layers and the second layers.

The objected to language is as follows:

> the at least one through plating truncated conical cross section profile . . . is electrically coupled to at least two layers of said first and second plurality of layers

Plain grammar indicates that the through plating is electrically coupled to at least two layers. These two layers may include one or more layers of both the first and second

plurality. That is, the at least two layers may comprise at least one layer from each of the first and second pluralities or two layers total from either of the first and second pluralities for a total of at least two layers. The term "coupled to at least two layers" means just that, at least two layers in total. The term "of said first and second plurality of layers" means that the at least two layers are taken from the first and second plurality of layers. The claim does not call for at least two layers of each of the first and second layers or four layers as asserted. Applicants do not understand the further assertion of "at least two of the combination of the first layers and the second layers."

Claim 23

This claim is rejected under 35 USC 112, 2nd and calls for:

> The component of claim 17 wherein the through plating extends through each of a third plurality of layers different than the first lower layer and is coupled to the third plurality of layers though which the through plating extends, the through plating being electrically conductive and at least two layers of said first and second plurality of layers to which the through plating is coupled are electrically conductive and in ohmic contact with the through plating. (underlining added)

In particular, the Action objects to the underlined language. Applicants do not understand the basis for this rejection. The objected to clause states that the through plating is electrically conductive. The at least two layers (electrically coupled to the through plating) of the first and second plurality of layers are in ohmic contact with the through plating. This is plain garden variety English. The at least two layers are ohmically coupled to the electrically conductive through plating. With respect to this rejection, the Action states: it is unclear if the claim is referring to [layers?] at least two of both the first and second layers, at least two of each of the first and second layers or at least two of the combination of the first and second layers.

This seems to be a repeat of the rejection of claim 20. This claim is definite for similar reasons given for claim 20. The at least two layers are taken from the first and second plurality of layers as discussed above in connection with claim 20. Claim 23 calls for at least two layers to be electrically conductive (these layers are each electrically conductive) and ohmically coupled to the through plating (each of these at least two layers is ohmically coupled to the through plating) not at least four layers as asserted by the Action if the at least two layers are construed as each being taken from each of the first and second plurality of layers not being claimed as such. The last clause of this rejection referring to the at least two of the combination is not understood. At least two of what? of the combination of the first and second layers is not described. If the term "at least two of the combination" is referring to the combination of the first and second plurality of layers, then this query does not make sense. This comment is applicable to a similar rejection made to others of he claims discussed above. This claim is believed acceptable under 35 USC 112.

The substantive rejections

Amended Claim 12

This claim is rejected as obvious over Friend in view of Sakai.. This claim is amended and calls for:

> A process for the production of at least one through plating of an electronic component comprising:
>
> forming a plurality of layers of different material including a first lower layer, a majority of which layers are of predominantly organic material and which plurality of layers includes an insulating layer, the forming of the first lower layer being followed by forming subsequent layers deposited sequentially one on the other contiguously onto and with the first lower layer, the forming of the first lower layer including forming a disruption element on the first lower layer, which element is arranged to result in a void in at least two layers of a first portion of the subsequently

> deposited layers on the first lower layer, and then forming a through plating in the resulting void through the at least two layers wherein at least two layers of a second portion of layers of the subsequently deposited layers are ohmically coupled to each other by the through plating. (underlining added)

The Action states that claims 12 and 13 are rejected over Friend (WO'938) and Sakai. There is no reference to Friend having the last three digits of '938 cited of record. Friend WO 0146987 is cited in the Notice of References Cited. The first named inventor in this reference is not Friend, but Sirringhaus. Applicants assume it is this reference that is intended as no other full citation to a Friend reference '938 is cited. Friend and Sakai are foreign to this claim taken singly or in combination.

The Action states that Friend discloses forming a void by forming a first lower layer including forming a disruption element of solvent material (Pages 33-34) on the first lower layer which element is arranged to result in a void in at least a first portion of subsequently deposited layers on the first lower layer. Friend does not teach this methodology.

Friend page 29 describes Fig. 12(a). Friend states: (line 5 of the first full paragraph)

> "In this example it is desired to form a via hole through the insulating PVP layer. Methanol is selected as the solvent because of its ability to readily dissolve PVP."

At line 8 from the page 29 bottom, Friend states

> "Note that when the via-hole reaches the bottom non-polar semiconducting layer the etching stops."

At page 30, Friend states "Figure 12 (b) illustrates the effect of the dropping of several droplets of methanol in sequence onto the via hole location." The Action refers to pages 33-34 of Friend as teaching the claimed disruption element of solvent material. This

portion of the Friend disclosure is irrelevant to applicants' claim 12 calling for:

> the forming of the first lower layer including forming a disruption element on the first lower layer, which element is arranged to result in a void in at least two layers of a first portion of the subsequently deposited layers on the first lower layer

The methanol solvent of Friend is not a disruption element as claimed. It is an etchant that is applied to the previously applied layers (not subsequently applied layers as claimed) for etching (dissolving the prior deposited layers of material it is applied to) and forming a via (a passageway) in the prior applied layer(s). The layer(s) to which the methanol is applied are not subsequently applied layers, but previously applied layers. They must be applied first in order to etch the vias therethrough via the solvent. The solvent is not a disruption element on a lower layer to form voids in a subsequently applied layer. It is a solution that is applied afterwards to prior applied layers. It is error to ignore express claim limitations.

Friend does not solve the problem to which applicants' claim solution is directed, i.e., to minimize disturbing the layers after they are applied. The claimed disruption element forms the void, i.e., the via, as the subsequent layers are applied to the underlying layer. See applicants' figure 3 for example. Friend is foreign to the use of disruption element as their etchant solvent is not a disruption element in the context of claim 12 that creates a void in subsequently applied layers. Using a solvent to later etch holes in a prior applied layer is totally different and not applicable to claim 12. Friend does not disclose the claimed disruption element.

The Action states that nothing in the claim requires the disruption element is formed on the first lower layer prior to forming subsequent layers. Applicants disagree

that the plain reading of prior claim 12 means otherwise. The prior claim 12 language called for the subsequent layers being applied on the first lower layer. If the layers are subsequently applied and they are applied on the first lower layer, then the construction of the Action of this claim is not according to the plain meaning of the terms used.

These terms do not mean anything other than the disruption element on the first lower layer forms a void in subsequently applied layers on the first layer. The terms have no other reasonable interpretation. The rejection is hypertechnical and proscribed.

However, to advance the prosecution of this application, the claim is amended to expressly meet the construction afforded by the Action, which construction is distorted from the plain meaning of the terms as would be construed by one of ordinary skill. Of course, as to claim 12 originally presented prior to the amendment made herein, the disruption element must be formed on the first lower layer prior to forming the subsequent layers, otherwise the claim makes no sense, especially in view of the specification. Claims are not construed in a vacuum, but in light of the specification.

Claim 12 is further rejected in view of Sakai. The Action states that subsequently deposited organic layers are coated on the lower layer having a disruption element 6. However, amended claim 12 calls for the underlined portion noted above not shown in Sakai. Sakai discloses a substrate 1, a lower wire 2 of titanium (Ti) , Ta or Mo (see the enclosed translation of Sakai). The layer 3 may be polyamide. An upper layer wire 4 is Al. The lower base layer 6 (the disruption element) is chromium (Cr). It repels the organic insulative material (3) at the section on the lower wire 2 at the bottom of via hole 5. [0014] Thus only one layer is repelled, the layer 3.

Claim 12 calls for a majority of the plurality of layers being of different material

and a majority of these layers are of predominantly organic material. Only layer 3 is disclosed as organic, the other layers 2 and 4 are metal, Al, Ti, Ta, or Mo, i.e., inorganic. The substrate 1 material is not described. In any case claim 12 calls for the void through at least two layers of subsequently deposited layers. Sakai does not disclose a void through at least two layers of such subsequently deposited layers, but only one layer, layer 3. Sakai is of no help with respect to what is missing in Friend and vice versa.

It would not be obvious to combine Sakai with Friend as Sakai would reconstruct Friend and vice versa in a manner to defeat their disclosed methodologies, e.g., etching the layers with an etchant, Friend, or using a repellant, Sakai, completely different and divergent technologies, the combination of which is not suggested by either, but by applicants' disclosure. It is improper to use applicants' disclosure as a guide to select only so much of the cited references as will meet a given need. Sakai does not disclose that their method would be operative on at least two layers to create a void in each layer in the manner as claimed. Their disclosure does not go so far and is speculative at most. Neither reference suggests its combination with the other outside of applicants' disclosure.

The Action states that Sakai teaches using an etching process referring to the abstract. Applicants fail to find support for this conclusion in the Sakai abstract which expressly states that the via hole is formed without an etching process, and thus teaches away from using the Friend methodology and vice versa. Claim 12 is believed allowable over these references. The remaining references cited of record are believed equally foreign to amended claim 12. This claim is believed allowable.

Claim 13, amended, includes elements similar to the steps in method claim 12, but in apparatus format as a component, and is believed allowable for similar reasons.

Claims 6 and 7 respectively call for the disruption element as a chemical and as a physical treatment of the first layer. Claim 7 further calls for the first layer to be a functional layer. Sakai does not suggest that the disruption element is a chemical or physical treatment of the lower layer or that the lower layer is a functional layer. The Cr layer used by Sakai as a repelling element is neither a chemical treatment, i.e., it is a coating on the lower layer not a treatment of the layer with a chemical, nor is it a physical treatment, a distortion of a layer, for example. These claims are believed further allowable for these additional structures.

As to claims 8 and 9, Friend is irrelevant since they do not disclose a disruption element and Sakai does not disclose the nature of their substrate 1.

As to Schmidt, he does not disclose a truncated conical in cross section through plating as claimed in the various claims directed to this structure. This reference was discussed in detail in applicants' prior response showing it is not relevant as asserted by the Action. This basis of the rejection is in error. For the reasons given, claim 13 is believed allowable.

Claims 17 and 20

These claims are rejected as obvious over Noddin in view of Kurashima and Jonas. These claims are not suggested by these references taken singly or in combination.

Claim 17 calls for:

a first plurality of layers including a second plurality of predominately organic functional layers, at least one of the first plurality of layers comprising a first lower layer and at least two others of the first plurality of layers, forming at least two central layers; and

at least one through plating having a truncated conical cross-sectional profile which extends from a wider cross-sectional profile region at, contiguous with and overlying the first lower layer through at least the two central layers transversely to the two central layers to a narrower upper cross-sectional region spaced from the first lower layer, the at least one through plating truncated conical cross sectional profile extending at least in part below the two central layers and is electrically coupled to at least two layers of said first plurality of layers. (underlining added)

Claim 20 calls for:

a first plurality of layers of different materials, each layer of the first plurality of layers being contiguous with at least one other of the first plurality of layers, the first plurality of layers including a second plurality of predominately organic functional layers, at least one of the first plurality of layers is a first lower layer and at least two others of the first plurality of layers are central layers; and

at least one through plating having a truncated conical cross-sectional profile which extends from and overlies the first lower layer through at least the at least two central layers transversely to the central layers, the at least one through plating truncated conical cross section profile extending at least in part below the at least two central layer and is electrically coupled to at least two layers of said first and second plurality of layers. (underlining added)

In Noddin, the via 12 does not extend from and overly a lower first lower layer as claimed in both claims. Via is an empty space. See the underlined portions of both claims. The Action suggests filling in the via of Noddin as suggested by Kurishama. However, if the via 12 of Noddin were filled in as suggested there is still missing the first lower layer from which the truncated profile extends and overlies as claimed. The via 12 in Noddin is an empty hole formed by a laser and if filled, the filling would not be

contiguous with a lower layer as claimed. This laser forming of the via is a destructive mode of hole forming admonished by applicants in their specification as discussed above with no first lower layer at the bottom of the via in which the via 12 could overly and be contiguous. There is no such underlying layer which the via 12 overlies.

In the Kurashima Figs. there also is no underlying first lower layer from which the truncated profile extends and overlies. See Figs. 1B, 2A, 4A, etc. A laser creates the via 18, Fig. 1B for example, somewhat similar to Noddin. An insulation layer 22 is then filled in the via. Fig. 1C. A further via 24 is formed in the insulation layer 22, Fig. 2A. The via 24 is then filled in with a conductive member 28. There is no lower first layer disclosed forming the Kurshamina device. The layers 30 in the various figures are solder joints not part of the components at issue. The solder joints are formed later as connectors to connect the filled in vias to other structures.

The solder joints do not form the claimed first lower layers of the plurality of layers of the claimed component. The solder joints are interconnections not part of the devices. A connector is not part of a device which it is connecting as would be understood by one of ordinary skill. Even if one were to fill the vias of Noddin as suggested by the Action, neither Noddin nor Kurashima disclose that a truncated profile extends from and overlies the first lower layer as claimed. In both references, the vias do not terminate at, overlie or extend friom a first lower layer from which such a profile can extend or overlie. These claims are believed allowable over these references.

New claim 27

This is a method claim presenting the invention in somewhat different form. This claim includes method steps some of which may be similar to those in method claim 12

or apparatus claims 13, 17 and 20 and are distinguishable over the cited references for similar reasons. Claim 27 includes the step of "forming a free-standing truncated conical cross-sectional profile through plating overlying and contiguous with the lower layer." None of the references cited of record disclose or suggest this structure for reasons discussed above. Neither Noddin nor Kurashima disclose such a lower layer as discussed. This claim also calls for "forming a plurality of further layers overlying and contiguous with the lower layer surrounded by and contacting the through plating extending therethrough." None of these cited references disclose such formation of layers overlying and contiguous with the lower layer and contacting the through plating which has been previously formed. The through plating, if at all present, is formed last in Kurashima, not initially. These references are foreign to this claim which is believed allowable.

The remaining claims depend from the independent claims, include all of the structure therein and are believed allowable for at least the same reasons. All claims are believed allowable.

Since applicants have shown that claims 1-15 and 17-27 are in proper form for allowance, such action is respectfully requested.

A $220 fee is believed due for the added independent claim, but not for otherwise for the additional claims. The fees for the total number of claims were previously paid for. A fee was previously paid for 41 total claims and three independent claims. There are now fewer claims than 41 total active claims.

The Commissioner is authorized to charge or credit deposit account 03 0678 the $350 fee for the one month extension of time and the added independent claim and any other under or over payments in connection with this paper.

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Claims

Claim 1

A formation method for multilayer wire characterized by forming a lower layer wire on a substrate, laminating onto said lower layer wire a lower base layer having a property that repels insulative organic material, forming on said lower layer wire the shape of said lower base layer at a position for formation of a via hole for a contact, application forming an intermediate insulative layer of an insulative organic material, and forming an upper layer wire on said intermediate insulative layer.

Detailed Description of the Invention

[0001]

Applicable Field in Industry

This invention relates to formation methods for multilayer wire structures in electronic devices such as image sensors, and it especially relates to formation methods for multilayer wire capable of manufacturing with favorable yield large area devices (LAE: Large Area Electronics).

[0002]

Former Technology

Electronic devices possessing a wire structure are implemented in wire structures of image sensors such as facsimiles and scanners.

[0003]

With LAE devices represented by the former close-fitting type image sensors and thermal heads, there is enabled reduction of the quantity of drive IC by combining switching elements with multilayer wires in a matrix shape, and this results in the ability to reduce costs.

[0004]

The structure of the former matrix-shaped multilayer wire is described by using the plane view description drawing of Figure 3 (a) as well as Figure 3 (b), being a cross section description drawing of section B-B' within Figure 3 (a).

[0005]

The former matrix-shaped multilayer wire structure was formed by sequentially layering onto substrate 1 a lower layer wire 2 constituted of titanium (Ti), tantalum (Ta) or

molybdenum (Mo), an intermediate insulative layer 3 constituted of an organic material such as polyamide, and an upper layer wire 4 constituted of such as aluminum (Al), and by conducting between upper layer wire 4 and lower layer wire 5 through contact via hole 5 formed in intermediate insulative layer 3.

[0006]

The following describes the formation method for the above explained former matrix-shaped multilayer wire structure.

[0007]

On substrate 1 is deposited a metal of titanium (Ti), tantalum (Ta) or molybdenum (Mo) at an extent of approximately 1000 angstrom, patterning is performed by photolithography and etching, thereby forming the shape of lower layer wire 2. Then an organic insulative material such as polyamide is applied by spin coating at an extent of approximately 1μm, and baked, thereby forming intermediate insulative layer 3. Next, contact via hole 5 is formed by applying resist to intermediate insulative layer 3 of such as polyamide, and by photolithography and etching. Upper layer wire 4 is then formed by depositing aluminum (Al), and by patterning by photolithography and etching. In this way, a matrix-shaped multilayer wire structure is formed.

[0008]

Problem the Invention Seeks to Solve

However, with the above described former multilayer wire formation method, intermediate insulative layer 3 is always formed by spin coating an organic material such as polyamide, but due to differences in film thickness between the central section and the peripheral section on a large area substrate, or due to irregularities in the baking of the polyamide, there are easily generated variations in the polyamide etching rate, and there are instances in which it is not possible to form contact via hole 5 to the size specified by the design, by which in the worst case there cannot be performed conductance between the upper and lower wires due to polyamide at the bottom of contact via hole 5 not being etched and therefore remaining in place, thereby decreasing the yield for the device.

[0009]

This invention is one that has considered the above described factors, and it has as its purpose the providing of a formation method for multilayer wire capable of forming the contact via hole without using an etching process for the intermediate insulative layer of organic material that is easily impacted by the variations in film thickness distribution and temperature distribution that accompany increasing the size of the substrate area, and thereby capable of manufacturing LAE devices with high yield.

[0010]

Means of Solving the Problem

In order to solve the above described problem of the former technology, this invention, being a formation method for multilayer wire, is characterized by forming a lower layer wire on a substrate, laminating onto said lower layer wire a lower base layer having a property that repels insulative organic material, forming on said lower layer wire the shape of said lower base layer at a position for formation of a via hole for a contact, application forming an intermediate insulative layer of an insulative organic material, and forming an upper layer wire on said intermediate insulative layer.

[0011]

Operation

According to this invention, at the position at which has been formed a contact via hole on the lower layer wire, there is formed a lower base layer with a material of such as chromium (Cr) having the property of repelling an insulative organic material of such as polyamide, over which is formed an intermediate insulative layer, and therefore the intermediate insulative layer is applied except at the position of the contact via hole, thereby enabling formation of the contact via hole on the conductive lower base layer without using an etching process for the intermediate insulative layer which is easily impacted by irregularities in film thickness and etching.

[0012]

Embodiment

The following describes an embodiment of this invention by referencing the drawings.

[0013]

Figure 1 (a) is a plane view description drawing of the multilayer wire according to the embodiment of this invention, and Figure 1 (b) is a cross section description drawing of the section A-A' in Figure 1 (a). Section with identical structure to that of Figure 3 are described using identical symbols.

[0014]

The multilayer wire of this embodiment is formed by consecutively laminating onto substrate 1 a lower layer wire 2 constituted of such as titanium (Ti), tantalum (Ta) or molybdenum (Mo), an intermediate insulative layer 3 constituted of an organic material such as polyamide, and an upper layer wire 4 constituted of such as aluminum (Al), and by conducting between the upper and lower layer wires through contact via hole 5 formed in intermediate insulative layer 3. The particular characteristic of this embodiment is that there is formed a lower base layer 6 of such as chromium (Cr) having the property of

repelling an organic insulative material at the section on lower layer wire 2 corresponding to the bottom of contact via hole 5.

[0015]

With the above described structure, the thickness of the lower layer wire 2 titanium (Ti), tantalum (Ta) or molybdenum (Mo) is at the extent of approximately 500~1000 angstrom, the thickness of the intermediate insulative layer 3 polyamide is at the extent of approximately 1μm, the thickness of the upper layer wire 4 aluminum (Al) is at the extent of approximately 1μm, and the thickness of the lower base layer 6 chromium (Cr) is at the extent of approximately 500 angstrom.

[0016]

Next, the following section describes the formation method for the multilayer wire of this embodiment by referencing the formation process cross section drawings of Figure 2 (a)~(d).

[0017]

First, in order to form lower layer wire 2 on substrate 1, there is deposited by a DC magnetron method a metal other than chromium (Cr) such as titanium (Ti) to a film thickness of approximately 500~1000 angstrom, and this is patterned by a photolithography process and etching process. It is further acceptable if this metal is such as tantalum (Ta) or molybdenum (Mo) (refer to Figure 2 (a)).

[0018]

Subsequently, as lower base layer 6, there is deposited by a DC magnetron method chromium (Cr) being a material that repels an organic insulative material such as polyamide to a film thickness of approximately 500 angstrom, and this is patterned by a photolithography process such that it remains only at the position at which will be formed a prescribed contact via hole (refer to Figure 2 (b)).

[0019]

As intermediate insulative layer 3 above the prior layers, there is applied by spin coating polyamide to a film thickness of approximately 1μm. At this point, the polyamide is repelled and not applied above lower base layer 6 of Cr, but it is applied onto all areas aside from lower base layer 6. thereby forming the opening that will become the contact via hole. Hardening is performed by baking for 1~2 hours at 200~250 degrees C in atmospheric pressure, thereby simultaneously forming intermediate insulative layer 3 and contact via hole 5 (refer to Figure 2 (c)).

[0020]

Thereafter, as upper layer wire 4, there is deposited by a DC magnetron method aluminum to a film thickness of approximately 1μm, and this is patterned by photolithography and etching processes to a prescribed shape. Additionally, there are instances of performing, prior to depositing the aluminum of upper layer wire 4, an O2 plasma descum process in order to completely remove any polyamide remaining at the bottom of contact via hole 5. The structure of the multilayer wire of this embodiment is formed in this way (refer to Figure 2 (d)).

[0021]

By use of the formation method for multilayer wire of this embodiment, there is formed lower base layer 6 constituted of such as chromium (Cr), which repels an organic insulative material such as polyamide, on lower layer wire 2 at the position at which will be formed contact via hole 5, and applied above these an organic insulative material, with the result that, at time of application of polyamide as intermediate insulative layer 3, the polyamide is repelled and not applied onto lower base layer 6, enabling the formation of contact via hole 5 without performing photolithography and etching of intermediate insulative layer 3.

[0022]

Furthermore, because etching of polyamide is not performed for intermediate insulative layer 3, there is enabled forming of contact via hole 5 to a specified size even when there is generated an irregularity in the film thickness of the polyamide or in the baking process, resulting in the ability to eliminate conductive failure in worst cases due to polyamide etching deficiency.

[0023]

Effect of the Invention

By use of this invention, there is formed a lower base layer of such as chromium (Cr), having the property of repelling an organic insulative material such as polyamide, on a lower layer wire at the position at which will be formed a contact via hole, and applied above these an intermediate insulative layer, with the effect that, the intermediate insulative layer is applied except at the position of the contact via hole, enabling formation of the contact via hole on the conductive lower base layer without performing an etching process on the intermediate insulative layer which is easily impacted by irregularities in film thickness and baking.

[0024]

Brief Description of the Drawings

Figure 1 (a) is a plane view description drawing of the multilayer wire according to the embodiment of this invention, and Figure 1 (b) is a cross section description drawing of

the section A-A' in Figure 1 (a).

Figure 2 (a)~(f) [sic] is a formation process cross section drawing of the embodiment.

Figure 3 (a) is a plane view description drawing of the former technology multilayer wire, and Figure 3 (b) is a cross section description drawing of section B-B' within Figure 3 (a).

Description of the Symbols

1 Substrate
2 Lower Layer Wire
3 Intermediate Insulative Layer
4 Upper Layer Wire
5 Contact Via Hole
6 Lower Base Layer